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PROBLEMS FOR SOLUTION.

ARITHMETIC.

77. Proposed by F. S. ELDER, Professor of Mathematics, Oklahoma University, Norman, Oklahoma.

For how many seconds must I count the clicking of the rails under a train that the number of rails counted may be equal to the speed of the train in miles per hour, a rail being 30 feet long?

78. Proposed by NELSON S. RORAY, South Jersey Institute, Bridgeton, New Jersey.

Solve by pure arithmetic, no algebraic symbols: A Texan farmer owns 5169 cattle; there are 3 times as many horses as cows, plus 569, and 4 times as many cows as sheep, minus 126; how many has he of each? [From *Brooks' Higher Arithmetic.*]

79. Proposed by F. M. PRIEST, St. Louis, Missouri.

How many $20 gold pieces can be put in a room 20 feet long, 18 feet wide, and 9 feet high?

GEOMETRY.

77. Proposed by CHARLES C. CROSS, Laytonsville, Maryland.

A line is drawn perpendicular to BC, of the triangle ABC, whose sides are $BC=a$, $CA=b$, and $AB=c$, through A to D, a distance d, (d being equal to or greater than $a+b$); from D a line is drawn to E, a distance e, (e being equal to or greater than $a+b+c$) on BC extended. Required the area of the ellipse which is isogonal conjugate to the straight line DE with respect to the triangle ABC.

78. Proposed by J. A. MOORE, Professor of Mathematics, Millsaps College, Jackson, Mississippi.

Required the number of normals that can be drawn from any point (a, b) to the parabola $y^2 = 2px$.

77. Proposed by JOHN MACNIE, Professor of Mathematics, University of North Dakota, University, North Dakota.

To construct a quadrilateral of given area, the diagonals, one of which is given, cutting each other in given ratios and at a given angle.

MECHANICS.

55. Proposed by ALFRED HUME, C. E., D. Sc., Professor of Mathematics, University of Mississippi, University P. O., Mississippi.

Three equal heavy spheres, each of weight W, are placed on a rough ground just not touching each other. A fourth sphere of weight nW is placed on the top touching all three. Show that there is equilibrium if the coefficient of friction between two spheres is greater than $\tan\frac{1}{2}\alpha$, and that between a sphere and the ground is greater than $\tan\frac{1}{2}\alpha n/(n+3)$, where α is the inclination to the vertical of the straight line joining the centers of the upper and one lower sphere.

56. Proposed by H. C. WHITAKER, A. M., Ph. D., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania.

"Hey-diddle-diddle, the cat and the fiddle,
The cow jumped over the moon."

Taking the weight of the cow to be 600 pounds, the initial resistance of the air to be 100 pounds and varying as the square of the velocity, find the initial and final velocities and the times of rising and falling.

57. Proposed b J. C. NAGLE, M. A., M. C. E., Professor of Civil Engineering, Agricultural and Mechanical College of Texas, College Station, Texas.

Over the intersection of two inclined planes slides a cord of uniform mass throughout its length. Find the equation to the path described by its center of gravity.

AVERAGE AND PROBABILITY.

54. Proposed by HENRY HEATON, M. Sc., Atlantic, Iowa.

A man is at the center of a circle whose diameter is equal to three of his steps. If each step is taken in a perfectly random direction, what is the probability, (1), that he will step outside the circle at the second step, and, (2), that he will step outside at the third step?

55. Proposed by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas.

It has been clear for 15 consecutive days, what is the chance of the 16th day being cloudy?

56. Proposed by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics and Physics in Drury College, Springfield, Missouri.

Find the chance that the center of gravity of a triangle lies inside the triangle formed by three points taken at random within the triangle. [From *Williamson's Integral Calculus.*]

NOTES.

NOTE ON MR. BECHER'S ARTICLE IN OCTOBER NUMBER OF MONTHLY.

BY J. R. BALDWIN, DAVENPORT, IOWA.

In Franklin A. Becher's article for the October number, (Vol. III), I notice he says, "Multiplying an infinite number by another gives us infinity of a higher power, or dividing gives us infinity of a lower power."

How does he reconcile the latter part of this statement with Wallis's expression for the value of π,

$$\tfrac{1}{2}\pi = \frac{2.2.4.4.6.6.8.8\ \ldots\ldots}{1.3.3.5.5.7.7.9\ \ldots\ldots}\ ?$$

In this expression, we have the quotient of two infinite numbers equal to a finite number.

Mr. Lilley's criticism (MONTHLY, Vol. III., No. 3.) of the solution IV. (MONTHLY, Vol. II., page 190) is undoubtedly valid, but the statement that "Todhunter failed to produce a direct proof of it" is probably incorrect. The theorem is given by Todhunter (Euclid, page 316) and in a note at the bottom of page 317 he says, "For the history of this theorem see *Lady's and Gentlemen's Diary* for 1859, page 88." If any reader of the MONTHLY has the Diary for that year I should be very much pleased to see the history of this theorem published in the MONTHLY. Todhunter's proof of the theorem is indirect, but that does not argue that he was unable to discover a direct proof. I remember that many